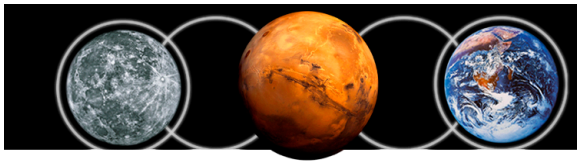


Human Factors Research & Technology

Patricia M. Jones, Ph.D.

Chief (Acting), Human Factors Research and Technology Division

NASA Ames Research Center

Human Factors
research and technology

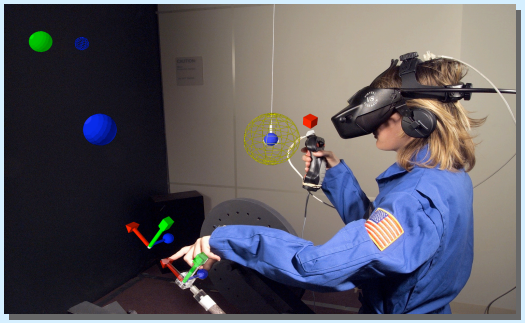
The Division at Ames Research Center

~200 Scientists and Engineers (most with MS or PhD)
- Psychologists, Computer Scientists, Pilots, Controllers

~ $50M full-cost budget in FY04

Strong working partnerships with aerospace community
- We host the Aviation Safety Reporting System (ASRS)
- FAA, NTSB, CAST, airlines, Boeing, maintainers...
- ISS, Shuttle, MER, Phoenix...

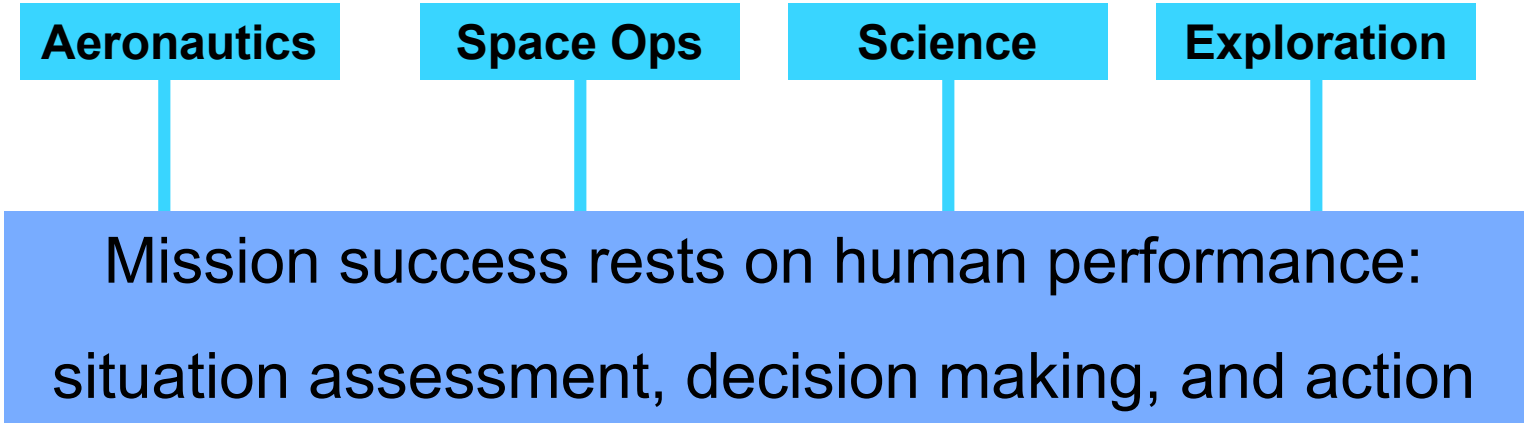
Core Science & Technology Areas:
- Aviation Human Factors: Training, procedures, air-ground integration, displays...
- Human Performance Modeling: Cognition, decision making, vision, fatigue...
- Multi-modal Interaction / Advanced Displays
- Human-Systems Integration and Systems Approaches to Risk Management



Products:
- NASA TLX, human performance models
- Aviation training packages, procedures, checklists
- System and interface design tools
- Design requirements / new concepts of operation
- Risk perception and management approaches

Patricia.M.Jones@nasa.gov http://humanfactors.arc.nasa.gov/

Human Factors is NASA's Future



Human Factors is NASA's Future

Aeronautics | **Space Ops** | **Science** | **Exploration**

Mission success rests on human performance:

situation assessment, decision making, and action

This Symposium!

- **Coordination in mission control/flight operations**
  - **shift handovers**
  - **inter-group collaboration**
- **Supervisory control of health and safety of spacecraft**
- **Collaborative interpretation of science data**
- **Human health and countermeasures in space flight**

Synergy Across Missions

- **Human Performance Studies, including**
  - Fatigue, decision making, attention, memory, stress, human error, vision, motor control, physiological adaptation
- **Human Support Technologies, including**
  - Human-automation interaction
  - Virtual environments
  - Flight deck / cockpit design and evaluation
  - Fatigue countermeasures
  - Crew Resource Management
  - Procedures, training, documentation

Examples of Synergy

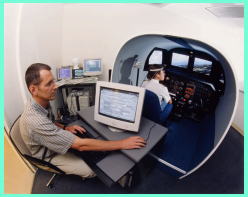
Virtual Environments for Teleoperation: Robotic Arm and Traffic Management Applications

Fatigue Studies for Ultra Long-Haul Flights, MER Ground Operations,and ISS Crew work schedules

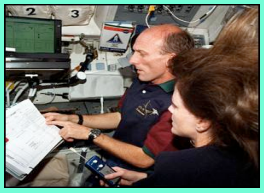
Crew Decision Making and Crew Resource Management for Aviation and Space Operations

Cognitive Models of Attention and Information Processing in Air Traffic Control and Shuttle Range Operations

Automation Design for Air-Ground Operations, Boeing 7E7, Shuttle, CEV, Mission Operations



Training for Line Oriented Flight Operations, Emergency Situations, Crew Interaction



Procedures and Document Design for Aviation Maintenance and Shuttle Maintenance

Vision Science and Visual Technologies for Flight Deck and Ground Control Displays

Human Factors at the Agency

- NASA Engineering and Safety Center includes Human Factors as a Discipline
- Mishap investigation boards now must include a human factors expert (NASA Procedural Requirement 8621.1A)
- Organizational Cause Statement of the CAIB Report
- Many other mission-centric activities

Still, Challenges

- Multiple Identities of Human Factors
  - Scientific field of inquiry
    - Therefore requiring research investment
    - Tradeoffs of generalizability and relevance
  - Part of systems engineering
    - Therefore requiring investment in requirements, design methods and metrics, validation, test, and integration with other aspects
    - Design tradeoffs in context

The Example of Validity

- **Experimental Validity in Behavioral and Social Sciences**
  - **Reliability vs Validity**
  - **Construct and Conclusion Validity**
  - **Internal and External Validity**
- **Verification & Validation (V&V) in Engineering/Software**
  - **Subsystem (“box”) versus System Level**
  - **By empirical tests, similarity, or analysis**

More Challenges: Misconceptions

- "Human factors is when some psychologist nags a hardworking engineer."
- "I'm a human and I use a computer. So I know about human-computer interaction."
- "I'm an articulate subject-matter expert and potential end-user of the system. So I am a human factors expert."

More Challenges: Misconceptions

- "Either your research agrees with my common sense or it doesn't. If it does, it's a waste of time and money. If it doesn't, it must be wrong."
- "We don't need human factors because our system is entirely automated."
- "Human factors is just asking people about what they want. Anybody can do that."

The Same Challenge?

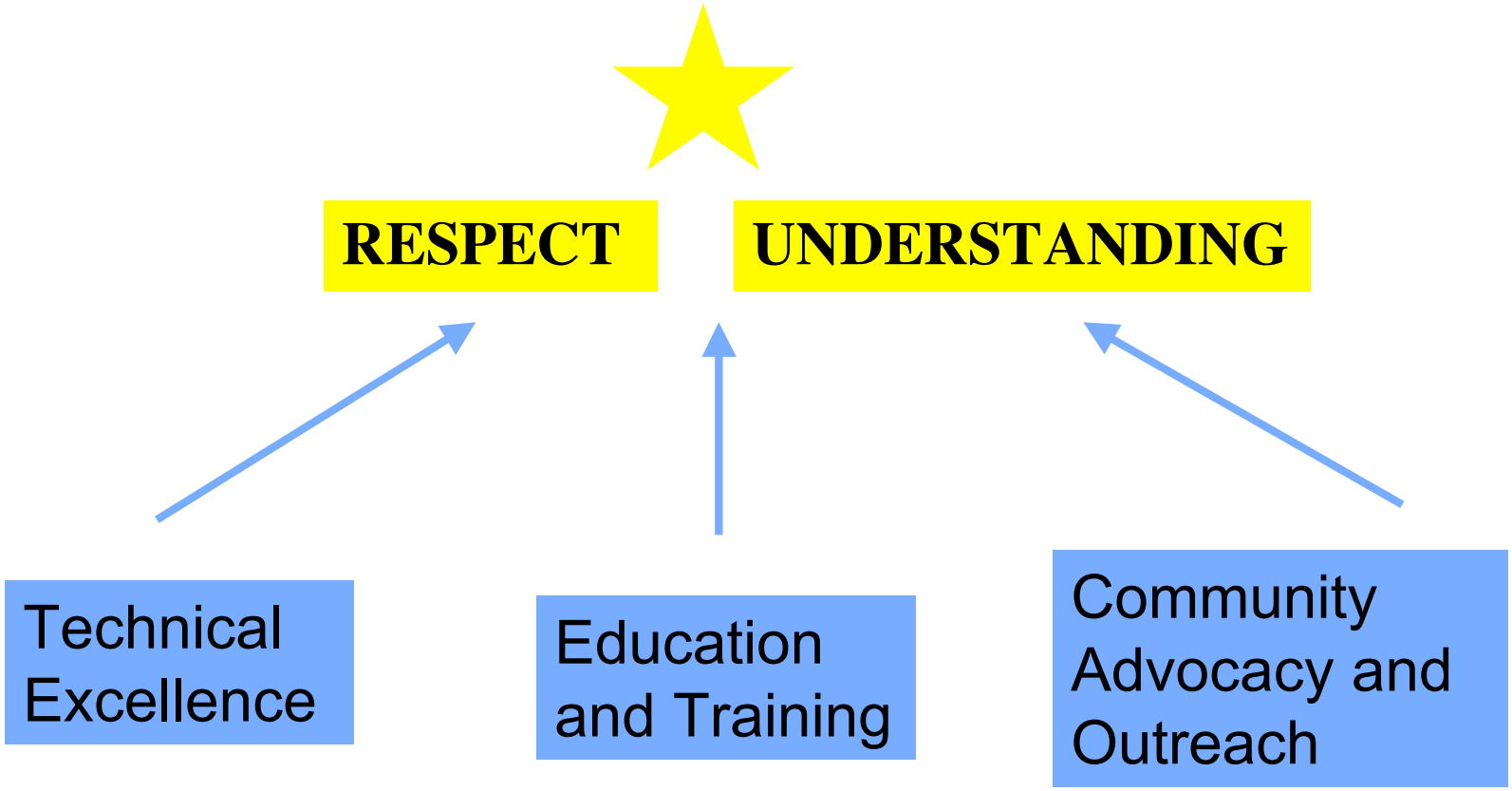
- "Get the right information to the right person at the right time in the right format…hasn't that been the same problem statement for Human Factors in the last fifty years?"
  - Sure, in the same way that "communication" and "design" are perennial challenges

Human Factors at NASA: A Plan for the Future

Human Factors is often recognized, sometimes respected, idiosyncratically applied, rarely well-funded

Human factors is routinely recognized, applied, and funded as part of the R&D process throughout the lifecycle

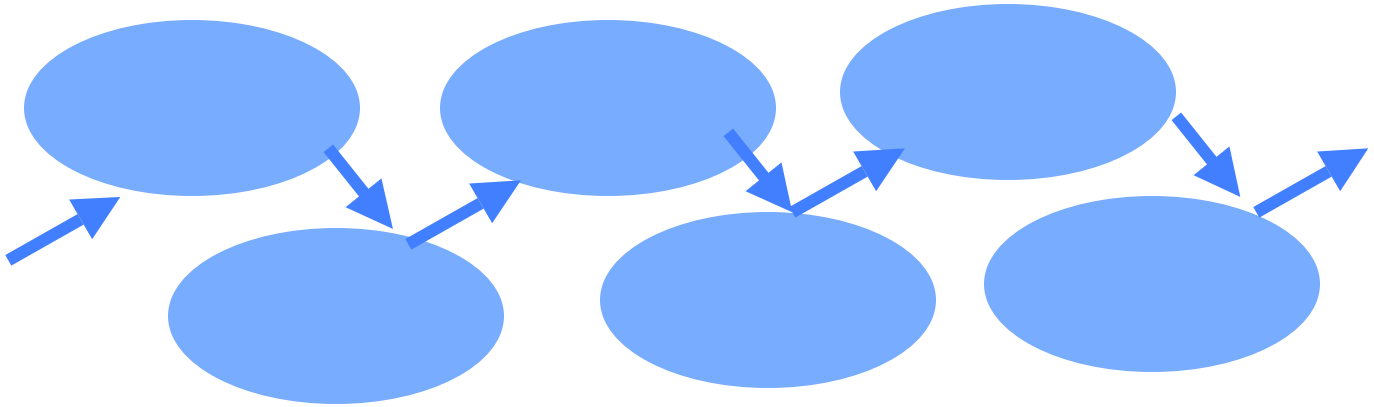
Human Factors at NASA: A Plan for the Future



Human Factors at NASA: A Plan for the Future

Technical Excellence	Education and Training	Community Advocacy and Outreach
Hire the best	**Middle and high school education programs**	**Form a community and develop advocacy plans for our customers and sponsors**
Train on the majority technologies	**NASA Training Courses**	

Human Factors at NASA: Towards a Technical Roadmap for the Future



Interleaving of human performance research with human support technology development

Human Factors at NASA: Towards A Technical Roadmap for the Future

- Characterizing "context" to appropriately frame problems
- Model-based prediction of human performance/error
  - Prediction based on system features/stimulus characteristics is particularly attractive
  - But also, the role of individual differences is crucial

Human Factors at NASA: Towards A Technical Roadmap for the Future

- A few of my specific favorite topics
  - Philosophies, levels, distribution of automation and collaboration in multi-human, multi-machine systems
  - How can decision support tools invite the right kinds of human performance (e.g., a proactive approach to managing risk) and how can you validate that?
  - Individual differences in risk perception and management

Human Factors at NASA

- Here's the start of our renewed community
- Thank you!